Consolidating and Advancing Knowledge of the Chemical Oceanography of the Arctic Ocean

Dr. Louis A. Codispoti
Center for Coastal Physical Oceanography
Crittenton Hall
Old Dominion University
Norfolk, VA 23529
phone: (757) 683-5770 fax: (757) 683-5550 email: lou@ccpo.odu.edu
award number: N00014-94-0682
http://www.ccpo.odu.edu/Facstaff/faculty/codispoti.html

LONG TERM GOAL

The long term goal of this project is:
To advance knowledge of the chemical oceanography and biogeochemical cycling of the Arctic Ocean with particular emphasis on changes that may be related to natural or man-related climate change and to man's impingement (i.e., pollution and changes in the hydrologic cycle).

OBJECTIVES

This particular project has 3 major objectives:

1) Facilitating the consolidation and dissemination of the scientific results of the Arctic Nuclear Waste Assessment Program (ANWAP).
2) Helping to ensure that chemical oceanographic data from the Arctic Ocean that were collected by the Former Soviet Union (FSU) do not disappear with the collapse of scientific infrastructure in the FSU.
3) Testing new instrumentation for autonomously collecting chemical oceanographic data from the Arctic Ocean and its adjacent seas.

APPROACH

Meeting objective #1 involves attending and helping to organize workshops, editing, reviewing, and writing. Meeting objective #2 involves interacting with FSU colleagues. Meeting objective #3 involves selecting and testing instruments that, with modification, may be capable of making autonomous nutrient measurements under high-latitude conditions.

WORK COMPLETED

Under objective #1 this project supported the publication of a paper describing the Arctic Nuclear Waste Assessment Program (ANWAP) and its initial results (Edson *et al.*, 1997, see publications section). The P.I. also participated in the review of the ANWAP risk assessment document. Publications relating to the long term goal of the project include a paper by Devol *et al.* (1997) that discusses biogeochemical cycling in arctic shelf sediments, and a book review by Codispoti (see

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
1998		**00-00-1998 to 00-00-1998**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Consolidating and Advancing Knowledge of the Chemical Oceanography of the Arctic Ocean	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Old Dominion University,Center for Coastal Physical Oceanography,Norfolk,VA,23908**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES
See also ADM002252.

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**Same as Report (SAR)**	**3**	

publications section). This project also provided support for an invited talk given by the Principal Investigator at the Gordon Research Conference on sea-ice ecology.

Under the aegis of objective #2, modest support was provided to a research team in the Former Soviet Union to further their efforts to study primary production and ecosystem processes in ice-covered seas. It is hoped that this collaboration will lead to significant sharing of data and ideas on the biogeochemical cycling that occurs in the marginal seas of the Arctic Ocean.

During the past year, accomplishments under objective #3 include continued research into the suitability and availability of *in situ* devices for determining nutrient concentrations in arctic waters. A syringe sampler has been constructed, an *in situ* nitrate analyzer (NAS-2E) purchased from WS Ocean Systems is in the initial phases of field testing, and results from the NAS-2E device, the syringe sampler and from pumped samples are being compared. Mr. Vincent Kelly, a formally a graduate student at Old Dominion University, has been added to our team as a full time employee, and he will concentrate his research efforts on optimizing and testing the WS Ocean Systems device with a view towards deployment in high latitude environments. Initial tests will include comparing the *in situ* results from this instrument with samples collected by the syringe sampler during co-deployments of both devices. Continued investigation of an instrument manufactured by Valeport that employs UV absorbtion to measure nitrate concentrations suggested that this device required additional development. Valeport has recently developed an improved instrument which they are marketing as an *in situ* UV spectrophotometer that may be capable of providing nitrate data with a frequency of about 1 Hz if it can be periodically calibrated against samples from the other types of samplers that we are working on. We continue to monitor progress of the UV-based instrument because of its potential for miniaturization and for obtaining high-frequency data, but interference from dissolved organic matter is still proving to be a significant issue. We also continue to investigate new instruments that come on the market such as the AQUA SENSOR manufactured by Chelsea Instruments Ltd.

RESULTS

During the past year, we have obtained initial test data on the NAS-2E *in situ* nitrate analyzer, and improved it *vis a vis* environmental friendliness by developing a standard preservation technique based on the Pasteurization technique of Aminot and Kerouel (1998).

IMPACT / APPLICATIONS

If we are successful in providing *in situ* instruments for determining nutrient concentrations in high latitude waters, a powerful new tool will be provided for monitoring changes in hydrographic structure and biological processes in the Arctic Ocean. Recent data suggest the possibility of significant decadal-scale changes in currents and hydrography, and nutrient data provide one of the better ways of monitoring hydrographic conditions in the Arctic. Our demonstration of high wintertime denitrification rates in arctic shelf sediments suggests that biogeochemical cycling in the Arctic can probably not be entirely neglected when attempting to model global climate change.

TRANSITIONS

Our review of the ANWAP risk assessment document should help to transition the information of this program in a format that is useful for policy makers in agencies that deal with pollution, living resources, and human populations in the Arctic. The good news is that the results do not suggest a major threat to U.S. waters and citizens from the dumping of nuclear waste material in the Arctic by the FSU. Given, the recently observed changes in the hydrography of the Arctic Ocean, success with improved instrumentation for autonomously obtaining nutrient data from the Arctic Ocean, should be useful to policy makers interested in how changes in the Arctic environment might influence Naval Operations, living resources and weather.

RELATED PROJECTS

None

REFERENCES

Aminot, A. and R. Kerouel (1998) Pasteurization as an alternative method for preservation of nitrate and nitrite in seawater samples. Marine Chemistry 61:203-208.